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Reported is a comparative study evaluating the effectiveness of an experimental teacher education program in developing knowledge of the processes of science and changing instructional decision behavior with preservice and inservice elementary school teachers. In general the program was successful with both groups, and it was concluded that preservice and inservice teachers who experience a similar teacher education program show some similar changes and some contrasting changes. Major differences were in the area of attitude change. (GR)

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A COMPARISON OF THE EFFECTIVENESS OF AN INSERVICE PROGRAM AND A PRESERVICE PROGRAM IN DEVELOPING CERTAIN TEACHING COMPETENCIES

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Introduction

The formation of federally supported national curriculum projects has led to the development of a number of new curriculum innovations. The successful implementation of these new curricula would seem to require teachers able to establish a learning environment in line with the philosophical orientation and instructional approach embodied in the new curricula. Indications that many teachers are unable to establish such a learning environment has led to the development of teacher education programs especially designed to develop the necessary competencies in teachers.

Certain teaching competencies have been identified as being essential for successful implementation of the new curricula. One competence is positive perception of the goals and methods of a

curriculum program. Butts (1967) states that to be successful, curriculum innovations

> require implementation by individuals who know and accept both the new philosophical orientation and the changed goals of the teacher and student (Butts, 1967, p. 29).

Another competence identified is facility in coping with a learning environment which emphasizes the child's responsibility for his own learning. The nature of the approach to learning espoused by a curriculum creates the demands for certain instructional skills. The approach emphasized by the new curricula does not make the student a passive recipient of information but an active participant in the generation of new ideas. DeRose (1965) states that to achieve this kind of behavior by the students the teacher must be able to

> engineer activities in which students (and teachers) are intellectually and physically involved in learning (DeRose, 1965, p. 9).

A third competence identified is knowledge of course content. The fact that in the new curricula the teacher does not serve as the only source of information does not imply that her knowledge of content is any less important. Karplus and Thier (1967) state that a sufficient background understanding of content is essential in order for the teacher to feel free to move with the children along divergent paths as contrasted to the more usual ones.

The effectiveness of a teacher education program in developing teaching competencies is dependent upon a number of factors. One major

factor is the nature of the participants of a program. Certain of the programs designed to prepare teachers to effectively implement the new curricula have been developed for use with preservice teachers as well as inservice teachers. These two populations differ markedly with respect to a number of characteristics such as amount of teaching experience, age, and recency of academic experience. It would seem possible that the different characteristics of the two populations could affect a program's ability to achieve its goals.

The major purpose of this study was to examine the relative effectiveness of a teacher education program given at the preservice level and at the inservice level in the development of certain teaching competencies related to successful implementation of a curriculum innovation. The specific teaching competencies studied were: knowledge of processes of science, positive attitude towards goals and methods of a curriculum innovation, and facility in coping with a learning environment which emphasizes the child's responsibility for his own learning.

The Study

Subjects

Four groups of individuals were included in the study. The preservice treatment group consisted of fifty-eight students enrolled in an undergraduate science methods course at The University of Texas

in which the preservice version of the program under study was used. The preservice no treatment group consisted of fifteen students enrolled in an undergraduate social studies methods course at The University of Texas. This group served as a comparison group for the preservice treatment group. The inservice treatment group consisted of twenty eight elementary school teachers enrolled in an elementary school science workshop in which the inservice version of the program under study was used. The inservice no treatment group consisted of eleven elementary school teachers enrolled in the summer school at The University of Texas. This group served as a comparison for the group above.

	Treatment	Comparison
Preservice Teachers	N = 58	N = 15
Inservice Teachers	N = 28	N = 11

Description of Sample Subgroupings
Figure 1

Treatment

The teacher education program under study has been developed through the joint effort of the Science Inservice Project of the

Science Education Center and the Research and Development Center for Teacher Education both at The University of Texas. Two versions of the program have been developed; one for preservice training and one for inservice training. The general goals of both courses are quite similar. The inservice course is structured to prepare teachers to implement a specific curriculum innovation, Science - A Process Approach. The preservice course is structured to prepare individuals to teach effectively within the framework of the new elementary science curriculum projects. Science - A Process Approach is used as a vehicle for the development of the desired competencies.

Data Analysis

Analysis of variance of pre-post change scores from the following instruments was completed.

Factor: Knowledge of the Processes of Science. Three instruments were used to measure the teaching competencies under study. The Science Process Measure for Teachers, designed by the Commission on Science Education of the American Association for the Advancement of Science was developed to measure a teacher's competency in the use of the basic science processes which form the organizing framework for Science - A Process Approach. In this study it was used as a measure of knowledge of processes of science.

Factor: Attitude. The semantic differential as developed by Osgood, Suci, and Tannenbaum (1957) is a technique to determine the

perception of meaning that an individual associates with a concept. A form of the semantic differential was developed containing protocol words which were related to the program under study. This was used as a measure of positive attitude towards goals and methods of a curriculum innovation.

Factor: Classroom Teaching Behavior. The Instructional Decisions Test was developed for use in this study. It was designed to provide an indirect measure of teacher classroom behavior. The test stimuli consist of a series of teaching situations presented on film. An examinee responds to these stimuli through written answers. These responses are coded and a numerical score generated. This score can be interpreted as a measure of the examinees instructional decision behavior. Initial studies have established a reliability of approximately .75. Efforts at establishing validity have involved determining correlations between the Instructional Decisions Test and data obtained from a classroom observational instrument. Several significant correlations were found between the Instructional Decisions Test and certain relevant scales of the Teacher Performance Competencies Scale. The Instructional Decisions Test was used in this study as a measure of facility in coping with a learning environment which emphasizes the child's responsibility for his own learning.

Comparisons were made of initial level of competencies and change in competencies for three sets of groups: preservice treatment and preservice no treatment, inservice treatment and inservice no treatment,

and preservice treatment and inservice treatment. These hypotheses were tested by means of analysis of variance.

Results

In the discussion below results which were found to be statistically significant at the .05 level or higher are reported as significant. The major results of the study can be summarized in relation to the following questions.

1. Is there any difference in change in knowledge of processes of science, instructional decision behavior, and attitude between members of the inservice treatment group and members of the inservice no treatment group?

The treatment group exhibited a significantly greater change in five of seven subscores as well as total score on the instrument used to measure knowledge of processes of science. The treatment group also exhibited a significantly greater change in two of three scales on the instrument used to measure instructional decision behavior. A significantly greater change was found in three of thirty-six scales on the instrument used to measure attitude. The treatment group exhibited a significantly greater positive change in their perception of the value and activity of inservice and the value of feedback to their teaching.

2. Is there any difference in change in knowledge of processes of science, instructional decision behavior, and attitude between

members of the preservice treatment group and members of the preservice no treatment group?

The treatment group exhibited a significantly greater change in two of seven subscores as well as total score on the instrument used to measure knowledge of processes of science. The treatment group also exhibited a significantly greater change in three of three scales on the instrument used to measure instructional decision behavior. A significantly greater change was found in five of thirty-six scales on the instrument used to measure attitude. The treatment group exhibited a significantly greater negative change in their perception of the value of a quiet classroom, value of teaching peers for practice, and value and activity of laboratory in the science methods course. A significantly greater positive change was found for the treatment group in their perception of the activity of behavioral objectives.

3. Is there any difference in change in knowledge of processes of science, instructional decision behavior, and attitude between members of the preservice treatment group and members of the inservice treatment group?

The inservice treatment group exhibited a significantly greater change in five of seven subscores as well as total score on the instrument used to measure knowledge of processes of science. No significant difference was found between the two treatment groups in change in instructional decision behavior. A significantly greater

change was found in six of twenty-seven scales on the instrument used to measure attitude. The preservice treatment group showed a significantly greater negative change in their perception of the value of a quiet classroom. The inservice treatment group showed a significantly greater positive change in their perception of the potency of science, value and activity of one-to-one and one-to-two teaching, value of teaching science, and value of feedback to their teaching.

Discussion

The results of this study suggest certain conclusions with respect to the effectiveness of the experimental treatment program in developing competencies in the participants. However, the design of the study permits several alternative explanations for the measured effects. In order to consider the conclusions relating to the experimental treatment in proper perspective, it is necessary to examine these alternative explanations.

The four groups involved in the study consisted of naturally assembled collectives. The fact that subjects were not assigned randomly from a common population to a treatment group and its respective no treatment group allows for selection bias as an alternative explanation for the measured effects. The more similar the treatment groups and their respective no treatment groups are in their recruitment and pretest scores the less plausible selection bias becomes as an

alternative explanation. The two preservice groups consisted of individuals who had reached a similar level in their professional education sequence. The two groups obtained similar scores on forty of the forty-seven criterion measures of the pretest. The inservice groups consisted of practicing teachers with similar lengths of teaching experience. The two groups obtained similar scores on forty-five of the forty-seven criterion measures of the pretest. Selection bias would seem to be more important in analysis involving the two treatment groups which consisted of individuals from two distinctly different populations. However, in this aspect of the study it is not the intent to determine the effect of treatment versus no treatment on two similar groups but rather the effect of the same treatment on two non-equivalent groups. Therefore certain of the alternative explanations such as selection bias, of concern in certain experimental designs, do not seem to relate to this part of the study.

The pretest scores of the four groups involved in the study were not equivalent. Thus, statistical regression represents an alternative explanation for the measured effects. The similarity in pretest scores for the treatment groups and their respective no treatment groups would seem to lessen the threat to statistical regression as an alternative explanation for that aspect of the study. The two treatment groups differed significantly on twenty-two of forty-seven criterion measures on the pretest. The group which was initially lower achieved

a significantly greater gain in eight of the twenty-two measures. Thus, regression would seem to be an important factor in the part of the study dealing with the two treatment groups.

Conclusions

The results of the study relate to the effectiveness of the experimental teacher education program in developing certain competencies at the preservice level and at the inservice level as well as a comparison of the relative effectiveness of the program at the two different levels. The design of the study permits more confidence in the results which relate to the effectiveness of the program at the preservice level and at the inservice level than to the relative effectiveness of the program at the two different levels.

The results of the study indicate that the total experience was successful in developing knowledge of the processes of science and changing instructional decision behavior of both preservice participants and inservice participants. The close similarity in pretest scores between the treatment groups and their respective no treatment groups and the high level of significance of the differences in gain scores allows for considerable confidence in this conclusion.

It was found that the total experience did affect attitude but only to a limited extent. The inservice treatment group showed a significant change on three of thirty-six measures while the preservice

treatment group showed a significant change on five of thirty-six measures. The concepts for which attitude changes were found differed for preservice participants and inservice participants. Inservice participants showed a change in attitude towards the program itself along with methods of instruction utilized in the program. On the other hand, preservice participants showed a positive change in attitude towards concepts related to the methods of the new curriculum under study in the program. The changes in attitude noted seem to indicate that the total experience had a bigger impact on the inservice participants. This could be due to the nature of an inservice program. For many teachers participation in an inservice program is a welcome break in the daily routine. On the other hand, the preservice version of the program is simply one of a number of courses taken by the participants. It is also possible that the change in attitude toward the program is related to how relevant the participants see the program. Inservice participants, having taught, can perhaps see a greater need for the type of help offered by a teacher education program.

The preservice participants had a significantly higher initial level of knowledge of the processes of science than the inservice participants. The level of knowledge of the preservice participants at the beginning of the program was approximately the same as that of the inservice participants at the end of the program. Does this imply

that preservice participants in general have a high enough level of competence in the science processes to not have to deal with it in the program? Would it be beneficial to determine the level of competence at the beginning of the program in order to spend time on the specific areas in which help is needed?

Both preservice participants and inservice participants made substantial change in their instructional decision behavior. The preservice participants began at a significantly higher level than the inservice participants and retained this difference at the end of the program. This could indicate that the aspects of the program which dealt with instructional decision behavior were of equal benefit to individuals at various levels of competence and with or without teaching experience.

In general, it was concluded that preservice and inservice teachers who experience a similar teacher education program exhibit some similar changes and some contrasting changes. Further study of these changes seems to support the conclusion that teacher education programs need to be constructed to meet the differing needs of the participants.

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